

SYNTHESIS OF BIODIESEL FROM DIFFERENT USED COOKING OILS VIA TRANSESTERIFICATION AND MAKING GLYCERIN SOAP FROM BIODIESEL BY PRODUCT

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ABSTRACT: Biodiesel is an alternative, renewable, cheap, clean-burning biofuel similar to conventional diesel and could be a replacing for petroleum-based diesel biofuel. The more amount of oil are getting waste annually so we decide to produce beneficial product from waste material. Cost of biodiesel produced from virgin vegetable oil through transesterification is higher than that of fossil fuel, because of high raw material cost. Catalysts used in this process are usually acids and base which will result in significant greenhouse gas saving compare to fossil fuels. The aim of the study is to utilize the waste oils and to replace the diesel for reduction of cost. In the present literature also says that production of biodiesel with these two oils (rap seed oil and coconut oil) was not yet reported. The main reason for this research is to use the used waste oil for biodiesel, it reduces greenhouse gas and emission, economically cheap, it is recyclable and biodegradable. It shows the good result in evaluation test for Biodiesel. It's also highlighting the global trend in biofuel demand and supply, its economic viability, environmental issue and about the next generation bio fuel which may overcome alarming issue related to depletion of conventional fossil reservoir.

Keyword: Biodiesel, Transesterification, moisture soap, Cost, Economic viability & Next generation bio fuels

I. INTRODUCTION

The main aim this research is large amount oil is consumed in our day-to-day life and the used oil is also not getting utilized. So, with this research work we can produce biodiesel from waste cooking oil and the yield of byproduct (glycerin) is also high so we aimed to prepare moisturizer soap with the biodiesel byproduct. The Indian government is severely depending on other countries for diesel and it's spending more currency for procurement of diesel. So, to reduce the dependency and expenditure it is better to synthesis biodiesel from waste cooking oil. It covers to objectives i.e utilization of waste cooking oil and reduction of expenditure of our countries. The present literature proving that it is possible to synthesize biodiesel with used cooking oil via chemical reaction like transesterification process. So, we made an attempt for the production of biodiesel with new oil like rap seed oil and coconut oil [1, 2]. Reusing of these waste oils and fats not only reduce the burden of the government in disposing the waste, maintaining public sewers, and treating the oily waste water, but also lower the production cost of biodiesel significantly [20].

Since the carbon in the oil or fat originated mostly from carbon dioxide in the air, biodiesel is considered to contribute much less to global warming than fossil fuels. Diesel engines operating on biodiesel have lower emissions of carbon monoxide, unburned hydrocarbons, particulate matter, and air toxic than when operated on petroleum-based diesel fuel. Neat (unprocessed) vegetable oil cannot be used in the compression ignition engines as it is reported to cause several problems due to its high viscosity. Biodiesel mixed with conventional diesel in some proportions can be used to run any existing conventional compression ignition engine and does not require any amendments to be done to the engine [20]. Due to benefits like renewable in nature, low cost and green house gas reduction potential, biodiesel is nowadays incorporated all over the world especially in developed countries like USA, France, Brazil in different proportions with diesel. It is also estimated that India can supplement 41.14% of its total diesel fuel consumption, if resources like waste cooking oil and other bio wastes were used as raw material for biodiesel production.

II. METHOD

Bio-Diesel Production Process:

Bio diesel production process is based on the transesterification reaction between triglycerides and alcohol. ^{[9][10]}

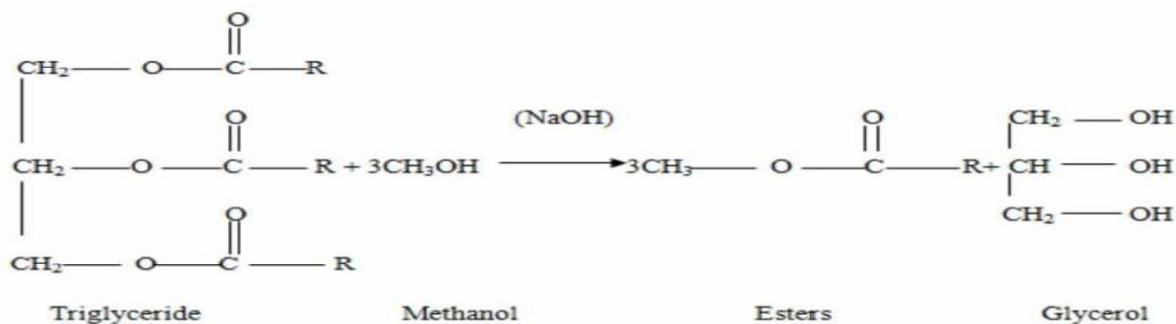
Transesterification Process:

Transesterification is the general term used for chemical reaction for the production of biodiesel from various triglycerides. Typical triglycerides react with an alcohol in the presence of an acid, base, or enzyme catalyst resulting in a mixture of fatty acid esters and glycerol. Among the alcohols, methanol is commonly used due to their low cost. ^[11]

There are three systems of transesterification, homogeneous, heterogeneous, enzymatic based on the catalyst employed in the process. In most of the cases methanol was used for the better efficiency. ^[12]

Esterification of rapeseed oil, separation of esterification products, methanol distillation and purification of the ester. The main stage of the process is based on the transesterification reaction of rapeseed oil with an alcohol which results in formation of esters of alcohols and glycerol.

Reaction:



Where, R is long chain hydrocarbons.

Experimental Method:

Collection & Filtration of oil: -

- Purchasing of rapeseed oil, coconut oil and converted into the mused oils by the frying process.
- Filtration of used oils to remove excess amount of particles which are present in the oil.

Preparation of Base: -

- Weigh required amount of Sodium Hydroxide (NaOH) and measure, add of methanol, dissolve the mixture on magnetic stirrer with the help of magnetic bead by maintaining temperature at 85⁰ C and keep it a side after the complete dissolving.

Heating of Oil: -

- Heating of sample oils to remove the moisture content which is present in the oil by maintaining temperature at 60⁰C.

Adding Base to The Oil: -

- After completion of heating the oil, base is added to the oil by drop wise method with the help of dropper after completion of adding cover the beaker with foil paper.
- And heat up to 1hr by maintaining temperature at 65-70⁰ C with frequent checking.

Separation Process: -

- After completion of reaction it is transferred into a separating funnel.
- Then the two layers are separated on is crude biodiesel and the other one is glycerol.
- Both are taken into a separate beaker are conical flasks.

Purification of Biodiesel: -

- To improve the quality of biodiesel, add equal amount of water into the conical flask and shake thoroughly and leave the conical flask to settle.
- Decant the water out this can be done twice if required.
- Then the pure biodiesel was obtained.^[13]

PROCEDURE FOR GLYCERINE SOAP:

Preparation of Lye:-

- Lye is prepared by taking 8.6g of sodium hydroxide and water equally and dissolves the mixture continuously with glass rod until it completely dissolves.
- Add 8.6ml of glycerin (by product of biodiesel) to the above mixture and lye was prepared.

Preparation of Soap: -

- Measure required of coconut oil and weigh sufficient of stearic acid and heat until its reaches 100C.
- Add the prepared lye to the heating mixture with continuous stirring and close the lid, heat up to 15 minutes until it gets transparent look.
- Now add denatured alcohol (ethanol, methanol) heat upto10minutes.
- After that add Poly Ethylene Glycol and break the lumps, heat up to 40minutes.
- Now add sorbitol solution and heat up to 45minutes.
- Pour the mixture into different soap moulds let it get solidify.^[16]

III. RESULTS

- ✓ 0.300ml (rap seed oil biodiesel), 1.5 liters (coconut oil biodiesel) of bio diesel was synthesized from used coconut oil via transesterification.
- ✓ Glycerin is the byproduct of bio diesel synthesis so glycerin soap was prepared from that glycerin byproduct.

Discussion

The rape seed oil, coconut oil which is used in this synthesis of bio diesel is very cheaply available in the market and contain rich number of triglycerides so it was one parameter to select.

The mechanism of the transesterification of vegetable oils by means of basic catalysis is well explained below. The mechanism comprises four stages. In the first step the base (catalyst) reacts with the alcohol, giving an alkoxides and the protonated catalyst. The second step consists in the nucleophilic attack of the alkoxides at the carbonyl group of the triglyceride, generating the alkyl ester and the corresponding anion of the triglyceride (third step). For the final step, this triglyceride deprotonates the catalyst, making it active and able to react with another alcohol, starting a new transesterification cycle. Triglycerides and monoglycerides are equally converted (to a mixture of alkyl esters and glycerol) by this mechanism.

The rapeseed oil, coconut oil which is used in the synthesis of biodiesel is very cheap in market and contain rich number of triglycerides. Because of using this oil, it produced more yield of biodiesel. For 500 ml of oil, it was produced 300ml of biodiesel. For 2000ml of coconut oil it was produced 1500ml of biodiesel. The evaluation parameters of flame test, pH determination test, freezing point, combustion test, flash point are acceptable and neutral when compared to the diesel.

Combustion test of biodiesel is less effective of green house gas emission and it has a good combustion. pH is also neutral to the biodiesel.

RESULTS:

S.no.	Sample oils	Flame test Color	Ph	Freezing point	Combustion test
1	Coconut oil	Orange color	6.5-6.8	16°C	36.5
2	Rapeseed oil	Bluish orange	6.5	13°C	33.1

Flash point:

S.no	Sample oils	Time taken for flash	Length of the flash point
1	Coconut oil	5seconds	40cm
2	Rapeseed oil	3seconds	35cm

Density :

The maximum measured value biodiesel density at 27°C was found to be

Sample oils	Density
Coconut oil	0.841
Rapeseed oil	0.839

IV. CONCLUSION

This study has shown that triglycerides hold promise as alternative fuels for diesel engine. It was observed from the report literature that the most of the transesterification studies have been done on edible oils like rapeseed, coconut by using methanol, ethanol and potassium hydroxide as a catalyst.

It is observed that the biodiesel properties are close to the diesel and satisfies fuel standards. It was reported that combustion characteristics of biodiesel are similar as diesel and the engine power output with biodiesel was found to be equivalent to that of diesel.

Moreover, the use of biodiesel in diesel engine results in drastic reduction engine emissions. The oxidation of biodiesel during storage period may be reduced by the use of antioxidants. Economic feasibility study shows that the biodiesel obtained from non-edible oil is cheaper than that from edible oils.

From this research we conclude that the biodiesel is a better alternative renewable fuel for the diesel.

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Biodiesel and glycerin separation



Glycerin soaps from biodiesel by product